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México, Factor: 6 sustainable agriculture

**Key Factor: sustainable agriculture** Developing and implementing sustainable agricultural practices (no-till, crop rotation, integrated pest management.) to combat erosion, desertification and soil depletion and reduce pesticide/herbicide use and minimizing environmental degradation associated with industrial agricultural practices.

I chose “Arroyo Seco” a municipality in the state of Queretaro, which is located in the central part of México. After some research, I could realize that this little town that is far away from urban areas is a great producer of many of the fresh products we consume every day, mostly vegetables and fruits. Even if they deal with many natural disasters during the year, they are one of the zones with more productivity in the country. Even with those complications, the farmers from “Arroyo Seco” are one of the main producers of vegetables and fruits in all Mexico, if we could help the community to improve the way in which they farm, the production and money they generate would be increased, leading to better work conditions in farms and rural areas, all around the country.

A typical family has 3.7 members (mother, father, and one child.) (INEGI)<sup>1</sup>. The area of “Arroyo Seco” is 71,720 hectares, from which, 2,164 correspond to the area sown, and 1,751 hectares of the harvested area. The farms have areas for agriculture and for animal breeding, as well as water tanks, and a house where the family lives. These farms are around 400 hectares and produce milk, meat from sheep, horses, eggs, chickens, and wool. They also produce avocado, prickly pear, corn, broccoli, beans, chili, tomato, mango, orange, lemon, and bananas. (arroyoseco.gob.mx)

In this town, the regular diet is based on products harvested or produced in the farms they own, they eat fresh products produced by them, even though almost all the inhabitants have a balanced and good diet, the education is one of the principal conflicts in this area, besides agriculture and health care. In 2016 the population from 15 and older, 1633 people didn't attend school. 3908 did not finish studying. 1279 have a basic education (Primary) and only 857 have finished college. This is because “Arroyo Seco” is a distant place from the main city “Queretaro” and the schools only teach up to elementary school. If the inhabitants want to have a better education, they need to emigrate to other towns or to cities like Mexico City even to the United States.

The medical assistance for the population is not good or enough, 10,843 residents of “Arroyo Seco” can receive medical treatments because the town has one clinic and one hospital. In the clinic there is a doctor and a nurse, meanwhile, in the hospital, there are two doctors and two nurses, only 6 persons to treat 12,910 patients, and the medical centers are not well equipped in case of an emergency.

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<sup>1</sup> INEGI is the National Institute of Statistics and Geography in Mexico.

Regarding the basic sanitary services, according to “INEGI”, in 2010 8,761 individuals out of 12,910 (72.1% of the total population) were in poverty, from which 6,450 (53.1%) had moderate poverty and 2,311 (19%) were homeless. In a month a family can make up to 668.00 dollars in a month, including the two parts of the family, almost half of this money is used in maintaining the farms and trying to rebuild what natural disasters destroyed.

Men and women must work, but because of the lack of schools they can only work in farms and low paid jobs outside the town trying to get better-paid jobs or inside as farmers or owners of little food stores, but the amount of money they can get from this jobs is really low.

The climate in this area is good for agriculture. It is good for production almost all time of the year, but they have big problems regarding the hardness of the land, and floods are very frequent in this place because there's no drainage system.

The problem “Arroyo Seco” has is floods and landslides mainly. Natural disasters are very often in this place because they take away all the seedlings which provoke low productivity. So, if we can prevent these effects the economy of many people can be increased such as their quality of life. They will not have to invest more resources in non-efficient solutions.

The fact they produce their own food is one of the advantages they have. They don't eat processed product from factories. They consume their own food, but, they can't produce a lot because of the disaster I've mentioned before. They lost most of the production, so they have to rationalize the food.

With a population of less than 13,000 persons who don't have access to higher education or to attend a University, it is a town which economy is based on agriculture and animal breeding, but they don't have the security equipment and lands to be a rising economy. They spend a lot of economic resources trying not to lose seeds and animals in floods and landslides that occur very often. And the government does not invest in the farms and lands, so the farmers have to use their own resources to produce, sell and plant without the support of anyone.

Climate changes are one of the most unpredictable and alarming factors that can affect the factor I chose. As “Arroyo Seco” is a rural area, and they don't have enough resources to face a big storm or landslides, people must emigrate looking for better life conditions leaving “Arroyo Seco” with no people to work the land.

If we focus on all these issues “Arroyo Seco” faces, we can think of some solutions:

My proposal as a solution to the natural disasters “Arroyo Seco” has, is to create a new way of planting seeds, in a more efficient way, building small structures that allow seeds to grow in an upper high level without having the risk of floods, using an efficient system to drain the excess of water, and strong enough to endure landslides using ECO boards as the main material, because it's light, it can let the water flow through it. As it is a long lasting material, the investment can be affordable, so the Eco board is also a solution to the drain problem of the water. Improving new seeding technology crops can be more efficient, be safe from natural disasters, floods, in this case, farmers can obtain more product, be more efficient and maintain their food fresh.

The basic structure of my proposal is composed of five ECO boards as the base, and the four walls, forming a kind of box. This model can be bigger by just adding more boards. For elevation we can use some bricks that can work as a barrier too. Depending on the product they are planting, the extension of the structure can vary, taking into account the quantity of water during the rainy season. With a small stair or even standing up farmers can access the plantations. Regarding the water administration, it can be made in a manual way by the farmers, and just leaving some space under the structure water can flow and can be drained without any problem.

My proposal can help the farmers in an efficient way because it can be applied to the vegetables and fruits. To have a plantation of green pumpkin there has to be a space of 30 cm between each pumpkin and it has to be at least 2.5 cm deep into the soil. The dimension of the Eco board is 58x43 meters, so the pumpkin can have the adequate space to grow, and it allows the farmer to have a better control of the land, and of the plantation. Only in 2016 “Aroyo Seco” produced 952 tons of green pumpkin which represented \$2,8846.45 dollars (SAGARPA)<sup>2</sup> .



ECO board design: <http://www.eco-boards.eu/i-gallery/gallery-photos/>

The advantages this system brings are that farmers can harvest all the crops, having them in a safe space, increasing the production and having a better control of the land. The biggest flood that has been reported was in 2017 with 60 cm of water inside the houses and in the streets, so the structure has to be tall enough so floods run below it. It is a simple model but it is an effective way to increase the production in “Arroyo Seco” .

There are around thirty small producers that count with 1 to 3 hectares for planting products, the production could be duplicated if we make an efficient planting system, built with “ECO board” it is an ecological and safe solution, as a building material, also the ECOboards is building from agricultural residues such as straw or reeds that can be easily found in farms.

The price of this is around fifty dollars for 58 x43 meters of ECO board, this is a very affordable material for farmers to build a higher plantation, that is durable and made of recycled materials that

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<sup>2</sup> SAGARPA is the National Secretary of Rural Development, Fishing and Agriculture.

can be found on the farms as an organic and inorganic waste, even though the processing of this material has to be done in factories, the price of production decreases if farmers bring their own materials making this even a better solution for the natural disasters “Arroyo Seco” has to face almost all the year.

Another material that can be used to reinforce the eco boards is recycled polyethylene coating. It is made with recycled plastic, from water pipes, this is waterproof and resistant to rust, the most commonly used size is 3000 x 2000 x 10mm, it's a little bit more expensive solution, but still being accessible, so farmers can reinforce the construction of the higher plantation, so water can't destroy the plantations.

The government of “Queretaro” is actually helping people, investing in schools and study institutions. The government invests 1,057,029.78 million dollars on subsidies to housing and medical centers, but there is no record of money used to improve farms and help crops.

This kind of system is being used on the island of Grenada (in the Caribbean) since 2004, but in this place, they are marking the contour lines across the plantation and making frames, so they can divert the water, and don't let the plantation drown, the frames are made of bamboo and rocks of all sizes which have to be changed every five years. This is a program supported by the “Food and Agriculture Organization of the United Nations” in this way they can improve the quality of the soil and generate 50% more products. My proposal can obtain the same results only by using natural recycled materials.

The climatic conditions of “Arroyo Seco” and Grenada are similar, in temperature, annual rainfall and ground type . The average annual rainfall in Grenada is 1524 mm (60 in). meanwhile in “Arroyo Seco” it is 1500 mm per year. The main difference between these two places is the population, in Grenada the population in 2016 was 107.00 people and in Arroyo Seco, there are 12,910 residents. But both suffer from natural disasters like landslides, floods, and erosion, so the solution I propose could be executed because the conditions of the land allow it. The reports from Grenada showed that this solution to erosion and floods is very effective, so it could be applied in “Arroyo Seco” having a good impact in the way farmers harvest the lands and making it a very viable solution.

In this way, the people that live in “Arroyo Seco” can have an affordable and ecological solution to their natural environmental problems, without losing any plantation, and increasing the production of vegetables and fruits. This can be an immediate solution to the problem the land is constantly suffering, and in this way, government support isn't necessary and farmers can build it, without the fear of losing crops.

Also, if we can work on a more efficient trade amongst farmers it would help their economy, reducing the time of delivering products, more market and trade opportunities, decreasing the product lost and generating a fair market for independent farmers.

By improving this factor the agriculture products generated by this town will be increased, that makes economy rise, and low the products price and be more accessible to people in cities that consume them, helping agriculture families in their regards and making a more efficient production in fruits, vegetables, and products from sheep, cows and chickens. With a easy and affordable

solution as the one I proposed, many families and marginated sectors of the country can have better conditions in the labor sector and in the health sector, leading to better life conditions in the rural areas across the country. All they need is a solution to the environmental problems, and the ECO boards, as a new form of farming, can be a great solution to help the agriculture families produce more products and help them grow without the help of the government or any other organization.

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